Mountain Pine Beetle Forum

MOUNTAIN PINE BEETLE & FIRE: THE SCIENCE BEHIND THE RISKS

Wednesday May 4, 2011 Colonial Red Lion Inn, Helena MT

~AGENDA~

Afternoon Session – All times are Mountain Daylight Time (MDT)

10:00am	Welcome	Paula Short, Montana DNRC
10:15am	Opening Remarks	Bob Harrington, State Forester and Forestry Division Administrator, Montana DNRC
10:30am	Effects of Bark Beetle-Caused Tree Mortality on Subsequent Wildfires	Dr. Jeffrey Hicke, University of Idaho and WWETAC*
11:15am	New Findings in Needle Moisture and Flammability – MPB & Wildfire	Dr. Matt Jolly, Missoula Fire Lab, USDA Forest Service
12:00pm	Lunch ($5 sack lunch available on-site)	
1:00pm	Predicting Fire Behavior and Spread in MPB-impacted stands	Dr. Russ Parsons, Missoula Fire Lab, USDA Forest Service
1:45pm	Canadian Wildfire Experiences in MPB-Impacted Stands	Dana Hicks, Fire Management, British Columbia
2:30pm	Local Panel – Experiences and Observations, MPB and Wildfire	Brad McBratney, USDA Forest Service, Sonny Stiger, Fire Behavior Consultant, Greg Archie, DNRC Area Fire Program Manager
3:15pm	Questions & Discussion	All

Evening Session

The evening session will run from 6:00pm to 9:00pm and will include the same presentations as the day session, but in a more concise, less technical format. Presentations will be shortened to 30 minutes (including Q & A) and the program will run straight through without breaks. Both sessions will be broadcast over the web.

“Mountain Pine Beetle and Fire: The Science Behind the Risks”
is sponsored by the Mountain Pine Beetle Forum, *USFS Western Wildland Environmental Threat Assessment Center, and the Tri-County FireSafe Working Group

Presenter Biographies

Greg Archie, Fire Program Manager, Central Land Office, Montana DNRC

Greg began his career in 1988 on the Kalispell Unit, MT-DNRC, as an engine crewmember. Since that time, he has gained extensive wildland fire operational experience through his performance as a Fire Team Leader, Unit Fire Supervisor and Fire Program Manager. Greg is currently a member of one of the Northern Rockies Type 1 Incident Management Teams (Poncin). His current wildland fire qualifications are Division Supervisor, Type 3 Incident Commander and Prescribed Fire Burn Boss Type 2.

Bob Harrington, Forestry Division Administrator and State Forester, Montana DNRC

Bob Harrington's academic travels have taken him from the Bonner Springs, Kansas public school system, to Kansas State University (where he realized he wanted to be a forester), to the University of Montana, where he received a Bachelor of Science in Forest Resource Management in 1983. His work travels have take him from the Clearwater Mountains of North Idaho with the U.S. Forest Service to the areas surrounding Missoula, Whitefish, Helena, Bozeman, and Billings, Montana, where he has worked for the Montana Department of Natural Resources for the past 20 years. His desire to experience a wartime evacuation from foreign lands led him to Tanzania in the U.S. Peace Corps prior to the Gulf War. His personal interests have led him to travels in Nepal, Ecuador, England, Holland, and most importantly China, where he found two wonderful daughters to keep he and his wife tired and happy. He has been the Montana State Forester since 2003.

Jeff Hicke, Scientist, Western Wildland Environmental Threat Assessment Center, USDA Forest Service

Jeff Hicke is a visiting scientist with the Western Wildland Environmental Threat Assessment Center, USFS, and an assistant professor of geography and environmental science at the University of Idaho. He studies the impacts of global environmental change on plants and animals. He is especially interested in the interaction of climate change, forests, and disturbances such as insect outbreaks and wildfire. Jeff received his Ph.D. from the University of Colorado at Boulder in 2000, moved to the University of Idaho in August 2006, and began at WWETAC in January 2010.

Dana Hicks, Regional Fire Management Specialist, British Columbia Ministry of Forests and Range

Dana has been in the position of Regional Fire Management Specialist with BC Ministry of Forests and Range in Prince George since 2006. During this time he has spent his time revitalizing the fire management process in British Columbia. He has serve as FBAN on several provincial Type I Incident Management teams. During the spring of 2009 Dana was export to Victoria State, Australia to help with their fire situation. He worked as a FBAN on the Kilmore Murrindini fire which burnt over 260,000 ha and killed 130+ people. He spent the summer of 2009 on several large interface fires in British Columbia. He is continuing to serve as an FBAN on Type IMTs and spent considerable time working with the MPB initiative and it interaction with fire. He also is an instructor on several national fire behaviour courses in Canada. In the early part of the 2000 he served as a deputy IC on the NE compact's type 2 team.

Matt Jolly, Ecologist, Missoula Fire Sciences Laboratory, USDA Forest Service

Dr. W. Matt Jolly is an Ecologist in the Fire, Fuel and Smoke Science Program of the US Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory in Missoula, MT. Upon graduation from high school in Ronda, North Carolina in 1990, Matt served for six years in the United States Air Force as a Satellite Communications Technician. After his military service, he attended the University of Virginia where he received a BA with high distinction in Environmental Science in 2000. He later moved to Missoula, MT where he earned a PhD in Forestry from the University of Montana in 2004. His main research interests focus on linking plant physiological processes with combustion and fire behavior characteristics and understanding the roles that live fuels play in current, operational fire behavior prediction systems that are used throughout the world.

Brad McBratney, Fire Management Officer, Lewis & Clark National Forest, USDA Forest Service
Brad's work experience consists of 5 seasons working in recreation, fire, and range on the Rocky Mountain RD, Lewis and Clark NF, from 1978 until 1982. In the spring of 1982, he transferred to Nez Perce Smokejumper base in Grangeville Idaho, where he jumped until 1987. Two of the winters he was stationed in Grangeville, he detailed to the Missoula Technology and Development center as a technical writer working on the structural range improvement handbooks and other related projects. In June of 1987, he transferred back to the Rocky Mountain RD as a range technician. In 1990, he became a resource assistant on the Rocky Mountain RD with staff responsibility for the range, soil & water, lands, roads and fire programs. In 2002, Brad became the Fire Management Officer for the Rocky Mountain RD and in July 2007 he moved to the Lewis & Clark NF Supervisor's Office as the Forest Fire Management Officer. In June of 2010 Brad detailed into the Zone Forest Fire Management Officer for the Lewis & Clark and Helena National Forests. Brad recently became the Zone Fire Staff Officer for the recently combined Lewis & Clark and Helena National Forest fire zone.

Brad has a BS degree in Forestry with an emphasis in range resource management from the University of Montana. He is a qualified FBAN, RXB1, OSC2 and ICT2. Brad is currently a member of the R1/R3 Wildland Fire Management Team.

Russ Parsons, Researcher, Missoula Fire Sciences Laboratory, USDA Forest Service
Russ Parsons received his B.S. in Forestry from the University of California, Berkeley, in 1992, his M.S. in Forestry from the University of Idaho in 1999, and his Ph.D. in Forestry from the University of Montana in 2007. Russ Parsons has worked in fire and resource management since 1992 in a variety of positions and with different agencies. Since 2000, Russ has worked at the Fire Sciences Lab, in Missoula, Montana, specializing in simulation modeling and spatial analysis. His current research integrates field work, laboratory experiments and simulation modeling to quantify fuel characteristics and improve our understanding of how fuels influence fire behavior.

Paula Short, Program Specialist, Montana DNRC
Paula Rosenthal Short is the facilitator for the Mountain Pine Beetle & Fire: The Science Behind the Risks, session. She serves as Planning and Public Affairs staff for the Forestry and Trust Land Management Divisions of the Montana DNRC. Paula has a BS in Forestry from the University of Montana and an MFA in Organizational Leadership from Gonzaga University. She lives in the Bitterroot Valley with her husband, Lem, and their son Colter; a baby girl will join the family over the summer.

Sonny Stiger, Fire Management Consultant and retired USDA Forest Service Fire & Fuels Management Specialist
Sonny retired after 26 years with the U.S. Forest Service as a Fire and Fuels Management Specialist, followed by ten years with Montana Prescribed Fire Services in the same capacity-a period of 36 years from 1956 to 1994. Sonny is still active as a Fire Management Consultant for the Tri-County FireSafe Working Group headquartered in Helena, MT., and as a Fire Behavior Analyst for the Lewis and Clark County Fire Council. He was a Co-Founder of the Tri-County Fire Working Group in 1984 and received the Keep Montana Green Association Fire Prevention Wildland Fuel Management Award in 2001 for his efforts in that arena. He is currently on the Board of Directors for Plan Helena, a Smart Growth advocate for planned development in the Greater Helena Area including the Wildland/Urban Interface and on the FireSafe Montana Board of Directors. Sonny has just recently received the first ever READY MONTANA award from the Governor's office for his volunteer service.

Special thanks to the agency partners of the Mountain Pine Beetle Forum, as well as the Western Wildland Environmental Threat Assessment Center and the Tri-County Firesafe Working Group for their partnership in developing and hosting this event.

WWETAC Western Wildland Environmental Threat Assessment Center

Western Wildland Environmental Threat Assessment Center

"Early detection and prediction of the potential effects of multiple, interacting threats and stresses across a range of spatial and temporal scales"

April 27, 2011

Effects of Bark Beetle-Caused Tree Mortality on Subsequent Wildfire

Principal Investigators: Jeffrey Hicke, University of Idaho/Western Wildland Environmental Threat Assessment Center, USDA Forest Service (USFS); Jane Hayes, Pacific Southwest Research Station, USFS; Morris Johnson, Pacific Northwest Research Station, USFS; Haiganoush Preisler, Pacific Southwest Research Station, USFS

Issue/background: Insect outbreaks are killing trees across millions of acres of forest in the US. These dead, red trees have raised public concerns about several issues, including damage to infrastructure, limitations to recreational activities, and, most prominently, wildfire. Some recent scientific studies have reported modifications to fuels and fire behavior following bark beetle outbreaks, and fire managers and field personnel have reported cases of modified fire behavior in beetle-killed stands. However, there appears to be disagreement among studies about the effects. Reconciling these disparate views is key to furthering a greater understanding of these disturbance interactions.

Objectives: Our objectives were to provide an updated, critical assessment of the state of the science, develop a conceptual framework that identifies changes in fuelbed and fire characteristics, and quantify the level of support and agreement among studies and for this framework in the published literature. We also sought to document gaps in knowledge.

Findings: Our review identified 32 studies that reported new results related to this topic. From these studies, we developed a conceptual framework describing changes in fuelbed characteristics and subsequent wildfire as a function of time since outbreak. We used three attack stages: 1) red-attack, when killed trees retained needles; 2) gray-attack, after killed trees lost needles; and 3) old-attack, after snags fell and during regrowth. During the red-attack stage, foliar moisture decreases, leading to higher probability of passive (torching) and active crown fire. During the gray-attack stage, needles fall from killed trees to the forest floor, reducing the probability of passive and active crown fire. During the old-attack stage, increased coarse fuels lead to higher reaction intensity and greater flame length. Also during this stage, ladder fuels (shrubs, advanced regeneration) increase, which enhances torching, and gaps in the canopy following snagfall reduce crown fire spread. We rated each reported fuel or fire characteristic within each study according to established criteria that considered where the study was published and its methods. We then quantified the support (agreement of published studies) or lack thereof (disagreement) for this framework. In the gray- and old-attack stages, most studies agreed with the conceptual framework. Some disagreement occurred with the conceptual framework for most characteristics, however. Few studies have addressed the red-attack stage, which we identified as a critical knowledge gap. A second key knowledge gap is in the capability of fire behavior models to completely simulate beetle outbreak conditions. In general, our review and synthesis finds substantial variability in the effect of beetle-killed trees on wildfire characteristics, with time since disturbance and fuel or fire characteristic crucial for determining impacts. Furthermore, large uncertainties in the reported responses of fuels and wildfire exist as a result of the small number of studies and the disagreement among studies, implying additional research is needed to provide useful information for resource managers.

Contact: Jeff Hicke, Western Wildland Environmental Threat Assessment Center/University of Idaho, 208-885-6240, jhicke@uidaho.edu

Mountain Pine Beetle-induced changes in Lodgepole Pine needle flammability

Dr. W. Matt Jolly, Dr. Russ Parsons, Ann M. Hadlow, Greg Cohn and Sara McAllister, US Forest Service, RMRS, Fire Sciences Laboratory

Mountain Pine Beetles alter wildland fuels in two ways: Chemically and Structurally

- Chemical changes happen quickly after attack as the energy reserves of the plant are expended and the flow of water from the roots is blocked.
    - These changes are generally perceptible as changes in the color of the foliage from a healthy green color to a yellow / orange and eventually to red.
    - They are associated with a large drop in the moisture content of the foliage and a change in the proportions of different compounds that make up the foliage.
        - Moisture contents are nearly 10 times lower in red needles as compared to healthy green needles. Moisture contents decline even before the foliage begins to change colors.
        - Red needles are much higher in compounds that give the needles their shape and rigidity and these compounds contribute the majority of the gases that make flames.
- Structural or physical changes occur years after an attack when the needles fall from the trees and much later when the trees fall to the ground.
    - Needles fall to the ground and add to fine surface fuel loadings.
    - Fallen trees later add as much as eight times more large diameter dead fuel loadings.
    - Live surface vegetation grows quickly in the absence of overstory foliage and can significantly change the live surface loadings.

Chemical alterations early during an attack can have profound influences on the flammability of the foliage

- Laboratory ignition tests reveal that red foliage can ignite nearly four times faster than healthy green foliage.
    - This means that less total heat is required to ignite attacked crowns and suggests a lower threshold for both a fire to carry from the surface into the crowns and for a fire to spread from crown to crown.
- Single tree model simulations show similar trends and suggest almost a doubling of the total net heat release from a red needle tree as compared to a green needle tree.
- These changes take place well before any structural or physical changes can be seen.

Take home messages

- Red needle have about ten times less moisture than green needles
    - Attacked trees can show moisture content and chemical changes before color change occurs.
- Red needles ignite more than three times faster than green needles
    - High crown base height trees may ignite unexpectedly
- Higher percentage of fuel is made up of fats and structural fiber and this also contributes to their flammability
- Spotting distances are farther and probability of ignition is higher in attacked stands
- There is a higher net heat release rate for red needle pines and this may lead to increase spotting distance

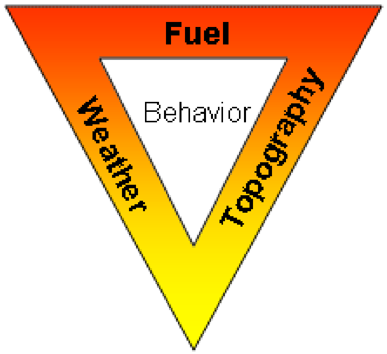

Figure 1 – The fire environment triangle showing that fire behavior is a function of fuels, weather and topography.

Modeling fire behavior in beetle-kill fuels: on the frontiers of fire science and disturbance ecology

Dr. Russ Parsons[1], Dr. W. Matt Jolly[1], Chad Hoffman[2],Dr. Rod Linn[3], Dr. William Mell[4], Greg Cohn[1],and Ann M. Hadlow[1]

[1] US Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, [2] University of Idaho, Moscow, ID., [3] Los Alamos National Laboratory, Los Alamos, NM, [4] US Forest Service, Pacific Northwest Research Station, Pacific Wildland Fire Sciences Laboratory

Fire behavior models provide information to guide fire management decisions

- Fire behavior models are computer programs which calculate how fires are expected to burn under particular weather conditions. Fire behavior models are used for many purposes.
- **At broad strategic or planning levels**, fire behavior models provide guidance for:
  - decisions regarding staffing and resource allocation
  - assessments of risk and hazard
  - evaluation of fuel treatments and other management actions.
- **At the operational and tactical level,** fire behavior models help fire managers with:
  - decisions about firefighter and community safety
  - decisions as to how best to carry out suppression/control activities.

Operational fire behavior models

- The several fire behavior models currently used operationally in fire management in the United States are all based on the same basic calculations, called the Rothermel surface fire spread model (Rothermel 1972). This model was developed largely from empirical observations made of fire spread rates in laboratory burn experiments. The model makes simplifying assumptions about fire and fuels which permit fast calculations but which also limit its applicability in certain situations.
- **Simplifying assumptions**
  - fuels are homogeneous ,continuous and contiguous to the ground -- designed for surface fire spread.
  - Quasi-steady state spread – fire not in transition but already "established"
  - Mechanisms of heat transfer not explicitly addressed (i.e., convection vs. radiation)
  - No spatial variability in fuels – considered as a homogeneous volume
  - No gaps / discontinuities between fuels
  - No fire-atmosphere coupling (so, the fire does not affect the wind field) – these couplings can produce rapid changes in fire behavior that have significant implications for firefighter safety.

Beetle-kill fuels do not fit operational model assumptions very well

- **Not homogeneous** -- Beetle kill stands include both live and dead trees, in close proximity. Red stage dead trees are much drier than live green trees. Our foliar moisture data and related chemical content and ignitability data indicate that green and red trees burn very differently. But operational models assume a homogeneous fuel – so an average of the two must be used. This is not representative of either red or green trees.
- **Not continuous** – gaps within tree crowns and between adjacent trees represent potential barriers to fire spread that are not accounted for in operational models. These distances and between-tree geometries are

likely very important in whether fires transition from surface fire to crown fires as well as in subsequent crown fire spread. Operational models are recognized as having significant issues with crown fire (Cohen et al, 2006).

- **Dead foliar moistures outside data range** – Crown fire predictions are currently made in operational models by linking the surface fire model (Rothermel 1972) with a simple empirical crown fire spread model (Rothermel 1991) via a crown fire initiation model (Van Wagner 1977). Operational fire behavior models are currently limited to foliar moisture content values of around 70% or higher (the data range used in formulating the models above), and have unreliable results at moisture contents lower than that value. This is much too high to realistically represent red stage foliar moistures.

Dynamic fire behavior models

- In recent years, new, cutting- edge fire behavior models have appeared with advanced capabilities that facilitate modeling fire behavior with greater complexity and detail. These models are dynamic and simulate fire in 3D space over time. Unlike the operational models which are largely empirical in nature, these models are capable of explaining HOW a fire evolves and burns. They can deal with much more complex (and realistic) fuels inputs and provide a much greater detail in outputs as well. This increase in detail expands the "solution space" for examining fuel-fire interactions such as beetle-kill fuels and fire. At present these models are only used in research but have great potential for providing robust science guidance for management.
- There are two main models:
    - **FIRETEC** – Los Alamos National Lab, Los Alamos, NM -- ***Dr. Rodman R. Linn***
        - For more information see reference list (Linn et al 2002)
    - **Fire Dynamics Simulator (FDS)** – National Institute of Standards and Technology, Gaithersburg, MD – ***Dr. William Mell***
        - For more information see reference list (Mell et al 2007)
- Capabilities:
    - Different means of heat transfer are explicitly modeled (convection, radiation).
    - Capable of handling discontinuities and variability within the fuel bed.
    - Capable of capturing transitional behaviors such as transitions to crown fire.
    - Finer scale: many small cells, 3D
    - "Coupled": fire-atmosphere, fire-fuels, fuels-atmosphere, topography-atmosphere

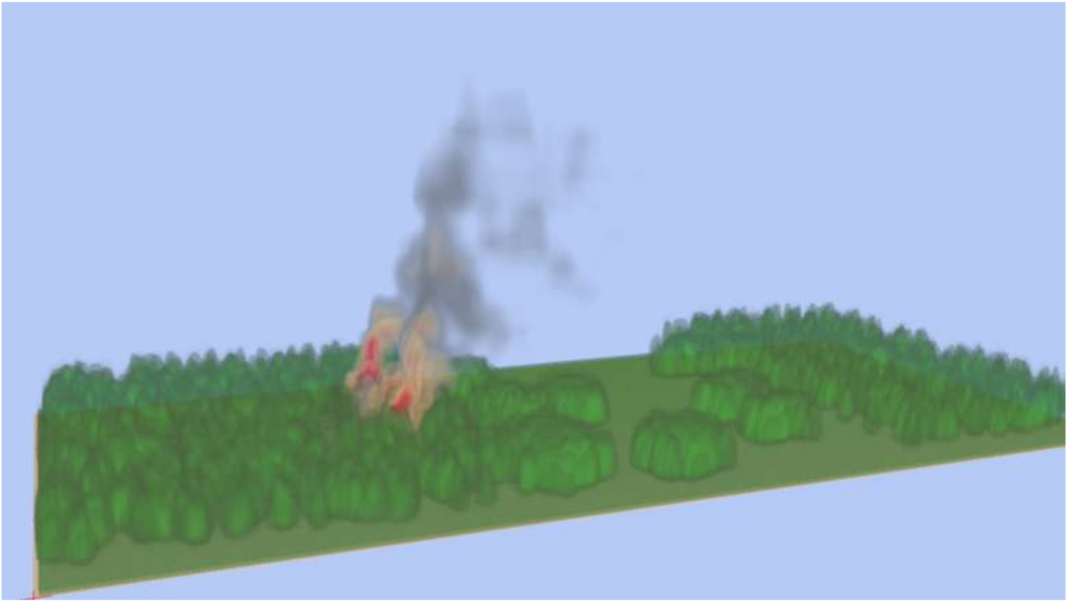

Figure 1. Simulation of fire burning in forest fuels with the FIRETEC model. FIRETEC is a state of the art fire behavior model which simulates fire dynamically in 3D. Unlike current operational models, FIRETEC can handle realistic and detailed fuels inputs – and produce realistic fire behavior outputs.

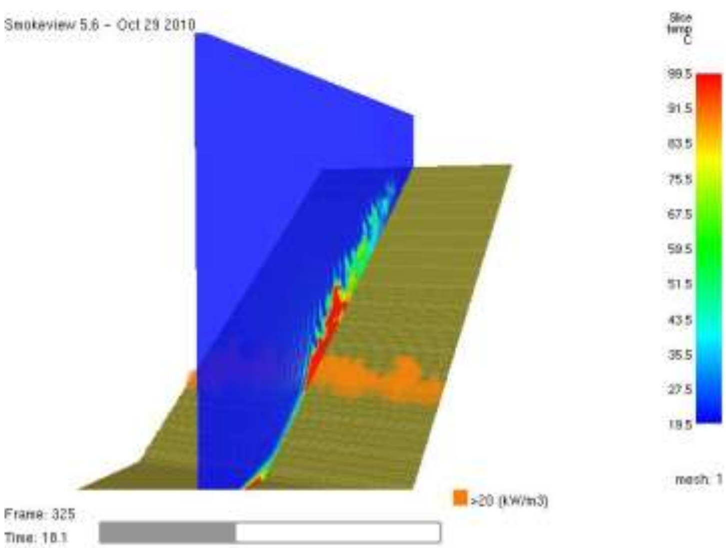

Figure 2. Simulation of fire on a hill slope with the FDS model. FDS, like FIRETEC, is an advanced fire behavior model which models fire dynamically in 3D. Here, FDS is used to examine how slope and wind interact to affect fire behavior. This information will help us to refine safety zone standards for fire fighters in complex terrain (a project currently in progress).

Beetle kill fuels change over time and space: a complex picture

- Pine beetles spread from tree to tree, generally favoring larger diameter trees, and avoiding non-host trees, such as fir. Over time, the stand structure changes substantially, and surface fuels change as well.
- These changes alter not only numerous characteristics of the fuel beds but also change how the stand interacts with the environment. These are referred to as *microclimate alterations*:

- Winds – as trees die and needles fall, their effect on the wind field diminishes. This means that beetle-kill stands with many gray stage trees likely have higher wind speeds and different wind patterns than un-attacked stands.
- Solar radiation regime – openings created by dead trees allow more sunlight to hit the forest floor, potentially drying out surface fuels faster. This may result in faster or more intense surface fires, particularly in older attacked stages where high woody debris loads may be common.
- Snow storage, hydrology, decomposition rates etc. – Numerous ecological processes are affected when the forest cover and structure changes. Many of these processes have subtle influences on fire behavior and fuels. Much still remains to be learned.

- Simulations examining beetle-kill fuel changes over time and associated fire behavior reveal complex interactions:
  - **Thresholds** – at low levels of beetle kill, changes in fire behavior may be minimal, while at high levels they may be substantial. Between these two extremes there may be regions in which large changes in fire behavior arise over a short range of fuel conditions. More work is needed to examine these relationships.
  - **Changes in fuel continuity**
  - **Changes in wind field dynamics**
  - **Changes in spotting regimes** – spotting (fire spread by burning embers lofted by the wind) may likely change a great deal in beetle killed stands, *both on the source side* (more embers, being lofted higher and traveling farther) and *on the target side* (lofted embers may ignite tree crowns directly). These changes have significant implications for crown fire spread and cannot be modeled with operational models. However, because dynamic models explicitly model the wind flow and its interactions with fuels and the fire, they can provide robust approaches for addressing these situations.

Dynamic fire behavior models add a lot to our fire science toolbox – and enable us to answer questions in complex situations.

- Answers to these questions strengthen our ability to reliably manage complex ecosystems in the presence of interacting disturbance agents (such as fire and beetle attacks) for the long run and for the benefit of future generations.
- We don't have all the answers yet. There is much more work to be done. But we are working on it – stay tuned.

References

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Fire Behaviour in Mountain Pine Beetle Stands
"The British Columbia Experience"

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Abstract

Lodgepole pine stands were always an aggressive burning forest fuel complex, but with the infestation of the mountain pine beetle the bar has been raised in terms of fire behaviour and suppression/ tactics.

Forest fires are now burning with devastating results, leaving large areas of blackened ground and wildland fire managers and resource managers frustrated and confused.

All wildland fire prediction models and fire suppression efforts are severely challenged in the burning of this "new" forest fuel complex.

Dana's talk will give the British Columbia experience with an unprecedented infestation and the resulting wildfires in this new fuel complex.

Prepared for FIRESAFE MONTANA NEWSLETTER by Everett M. “Sonny” Stiger, April 20, 2011

Even though the wild land fire weather has been rather mild for the last couple of years, we have been experiencing some rather intense wild land fires in the mountain pine beetle infested stands within the Tri-County FireSafe Working Group. The forested areas of Broadwater, Jefferson, Lewis & Clark and Cascade counties have been hit hard by the beetles. Several hundreds of thousands of acres are red and dead and green and dead. This latter category of green and dead has been more of a problem than the red/dead. Our fire fighters on the front lines have noticed that the green/dead are burning with more intensity and carrying a crown fire more readily than the red/dead. Matt Jolley and others at the fire lab in Missoula have found that the green trees that are just recently hit by the beetle have lost as much as 50 % of their foliar moisture. These trees, still possessing their resins and turpens, have been transitioning from a surface fire to a crown fire faster and with more intensity and speed than we have experienced in the green healthy trees in previous years even with drought conditions. A recent example is the Davis fire near Helena, Montana that burned in a mixture of Lodgepole pine and Alpine fir with a 50 to 70 % red/dead component. This fire exploded from a small spot fire to 3 acres in two minutes, 10 to 15 acres in the next eight minutes and to over 100 acres in the first hour with rather mundane weather. The air temperature at the time was 78 degrees F., with a relative humidity of 28% and light winds.

This kind of fire behavior has been witnessed over the last couple of years in the beetle infested Ponderosa pine stands as well. These stands of Ponderosa pine are particularly vulnerable to spot fires due to a heavy buildup of this long needled pine (4 to 5 inches) on the forest floor and hanging up in the lower tree branches and on the underbrush. The North Fork fire in this Ponderosa pine type near Wolf Creek, Montana, grew quickly from a 10 to 15 acre running crown fire to 70 acres of spot fires. Hundreds of embers created hundreds of spot fires that could coalesce and create a mass ignition. It has become obvious that our fire fighters must be cognizant of the Probability of Ignition when in initial attack. A Probability of Ignition of over 60 in beetle infested stands of Ponderosa pine should be a Red Flag for the possibility of a mass ignition.

Not only are we witnessing increased spotting potential, increased rates of surface fire spread, increased fireline intensities and increased crown fire potential, all a concern for the safety of our fire fighters and civilians, but we also have a serious potential for widow makers. Trees attacked by mountain pine beetles are breaking at mid-tree and uprooting more easily than other dead trees that have not been attacked.

FIRES IN THE MOUNTAIN PINE BEETLE INFESTED STANDS WILL REQUIRE A HIGH LEVEL OF VIGILANCE AND FIRE BEHAVIOR EVALUATION FOR FIRE FIGHTER AND CIVILIAN SAFETY.

THE FOLLOWING GUIDELINES SHOULD BE OBSERVED WHEN WORKING IN BEETLE INFESTED STANDS:

<u>THERE WILL BE INCREASED SPOTTING POTENTIAL.</u>

Numerous spot fires can ignite at the same time and coalesce, creating, a mass ignition.
More convection will result in increased spotting distances.
More receptive fuel beds will facilitate spot ignition.
Be aware of the Probability of Ignition and the Ignition Component of the daily Fire Danger Rating. Either of these indices over 60 is cause for concern in beetle infested areas.

THIS VOLATILE FUEL TYPE IS CAPABLE OF RAPID RATES OF SPREAD.

SNAGS WILL BE MORE NUMEROUS AND WILL BECOME INCREASINGLY UNSTABLE.

Extra caution will be required when doing helicopter and sawing operations.
Air tanker retardant drops can be particularly dangerous.
Reevaluate your escape routes after any wind event.

LCES-OS

Lookouts:
Maximize field of view and look for spots far beyond where usually expected.
Spots have potential to establish much faster than normal.
Fires in beetle-kill may expand in all directions with seemingly negligible winds.
Know what your fire is doing at all times, observe personally and use scouts.

Communications:
Fires have increased potential to go big quickly.
It is imperative to stay in contact with your supervisor, your crew, and adjoining forces.

Escape Routes:
Downfall from beetle-killed trees means you will need more time to access your safety zone.
Constantly reassess your escape routes.
As winds increase, falling trees may compromise your escape route.
Establish and maintain a secure anchor point.

Safety Zones:
Heat release from the flaming front could be two-times normal.
Maximum rate of heat release will occur sooner than in green, healthy trees.
Consider increasing the width of the Safety Zone to eight times the flame height.

Organization and Supervision:
Make certain that accountability is established and that the organization is utilizing the Incident Command System.
Know where your people are at all times.
Give clear instructions and make sure they are understood.

FIRE WEATHER
Recognize current weather conditions and obtain forecasts.
In beetle infested timber stands consider a relative humidity of 20% to be the threshold for aggressive burning.
At this humidity level all sources of ignition are dangerous.
Spot fires occur often and spread rapidly.
Extreme fire behavior is probable.
Critical burning conditions can be expected.
Be constantly aware of the potential alignment of wind, slope, direct sun light, and topography.
Constantly analyze potential fire behavior. Are things going to get better or worse and if so when?

We will be dealing with the aftermath of this infestation for decades to come.
Although the fundamentals of fire fighting have not changed, firefighter awareness needs to be heightened when operating in this growing fuel type.